LOGI-DRIVE AI VISION PRO

Al-Azhar University
Faculty of Engineering
Electronics and Communications Department

Graduation project

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Agenda

1. problem & solution
2. Vision Assistance
3. Logger System
4. Firmware Over-the-Air (FOTA)
5. Lane Departure Warning (LDW)
6. Main System (GUI)
7. System Design
8. Tools
9. Conclusion

problem & solution

problem & solution

- **Problem**

Car recalls due to safety or manufacturing defects.

- **Impact**
  - Cost the automotive industry billions of dollars annually.
  - Damage to brand reputation and consumer trust.
- **Mitigation Potential**
  - Prompt handling of recalls can reduce long-term harm.
- **Challenges**
  - Logistical difficulties in managing recalls.
  - Poor consumer response and engagement.
  - Delays that extend negative consequences.

PROBLEM & SOLUTION

Problem

Increased car accidents on fast roads during low-light conditions (e.g., night or fog).

Causes

- Reduced visibility for detecting obstacles and judging distances.
- Delayed driver reactions due to poor lighting.
- Headlights alone are insufficient at high speeds.

Risks

- Higher risk of severe collisions on highways.
- Even small delays in reaction time can be fatal.

Affected Areas

- High-speed roads like highways and expressways.

Proposed Solution

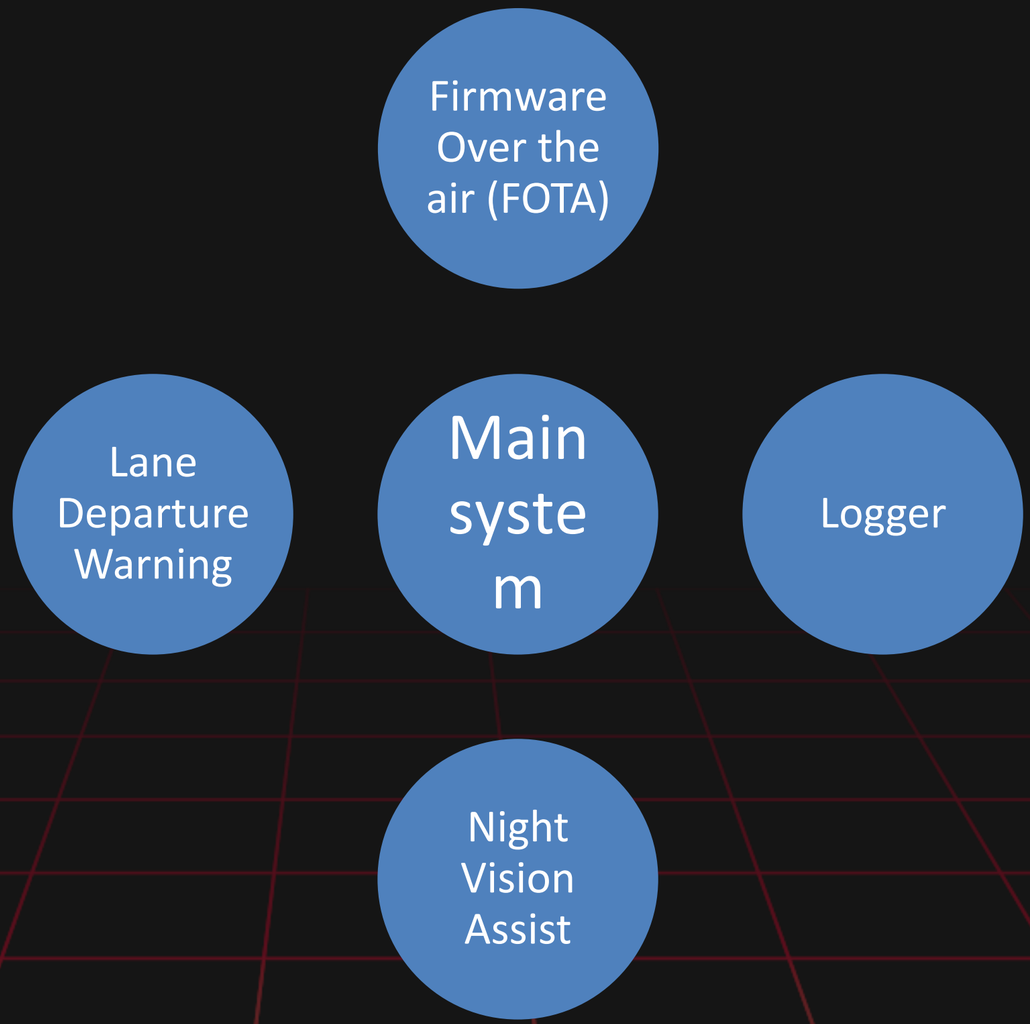
- Use of advanced night vision systems.
- Integration of AI-powered driver assistance technologies.

Goal

Enhance visibility and improve driver safety in low-light environments.

Integration Of AI Vision

Subsystems

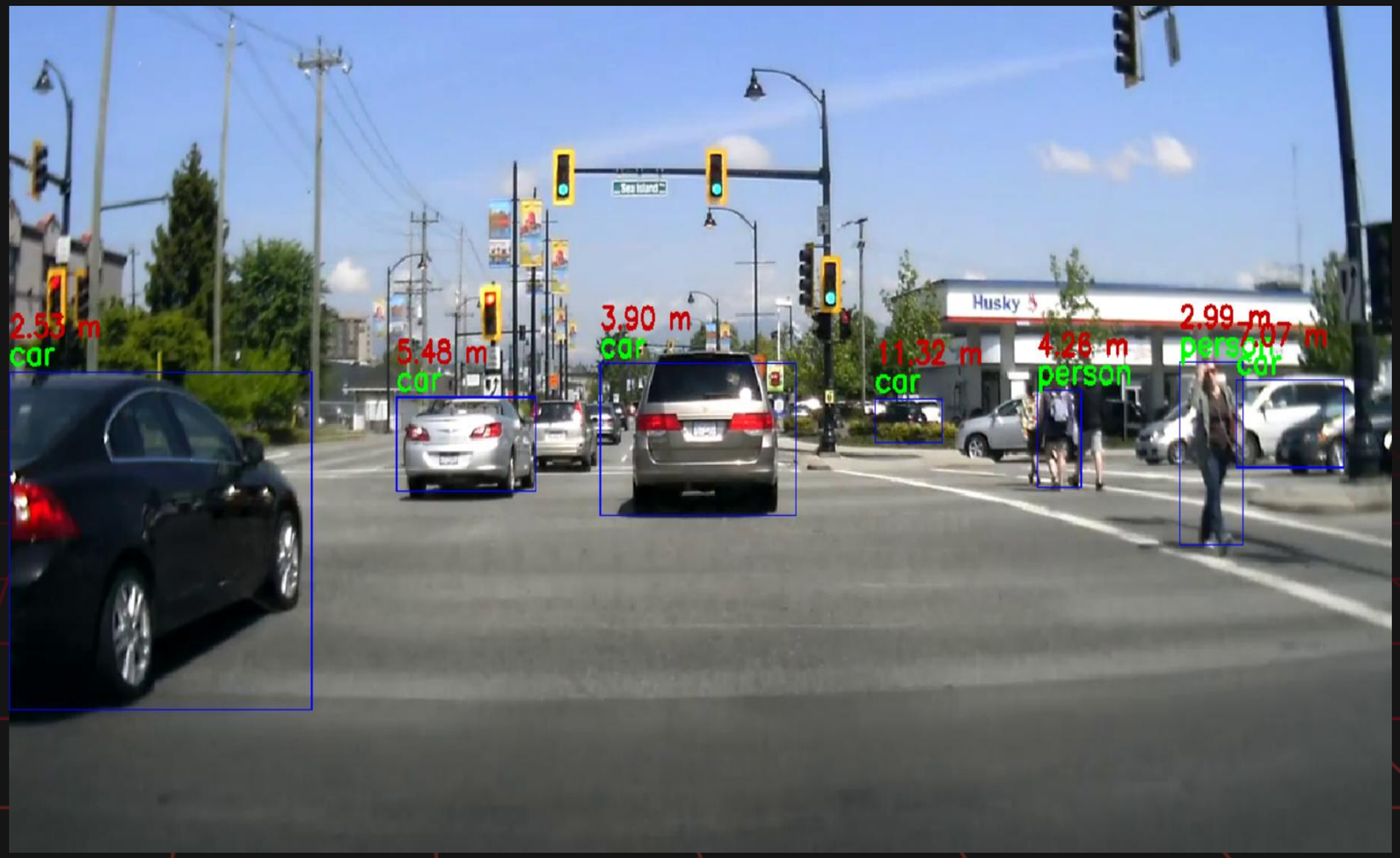


Vision Assistance

Vision Assistance

- Assist drivers during night-time or low-visibility.
- Provide real-time visual analysis using an IR camera.

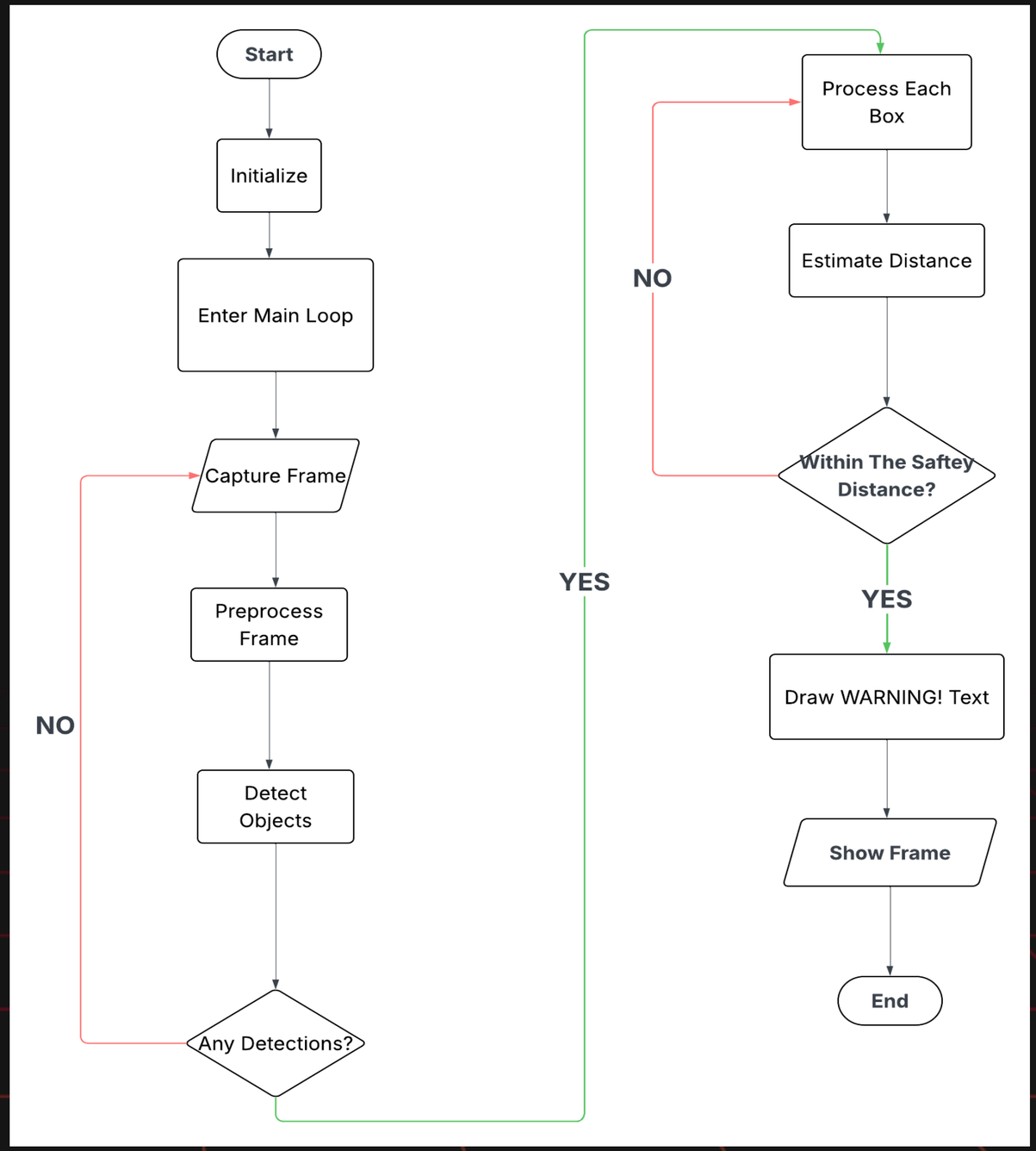
- Detects objects of the road .
- Estimate the distance and motion state .



- Alerts the driver when object is close enough
  - and in front of the car .

- It displays STOP! Sign when object is too close to alert the driver .

HOW THE SYSTEM WORKS ?



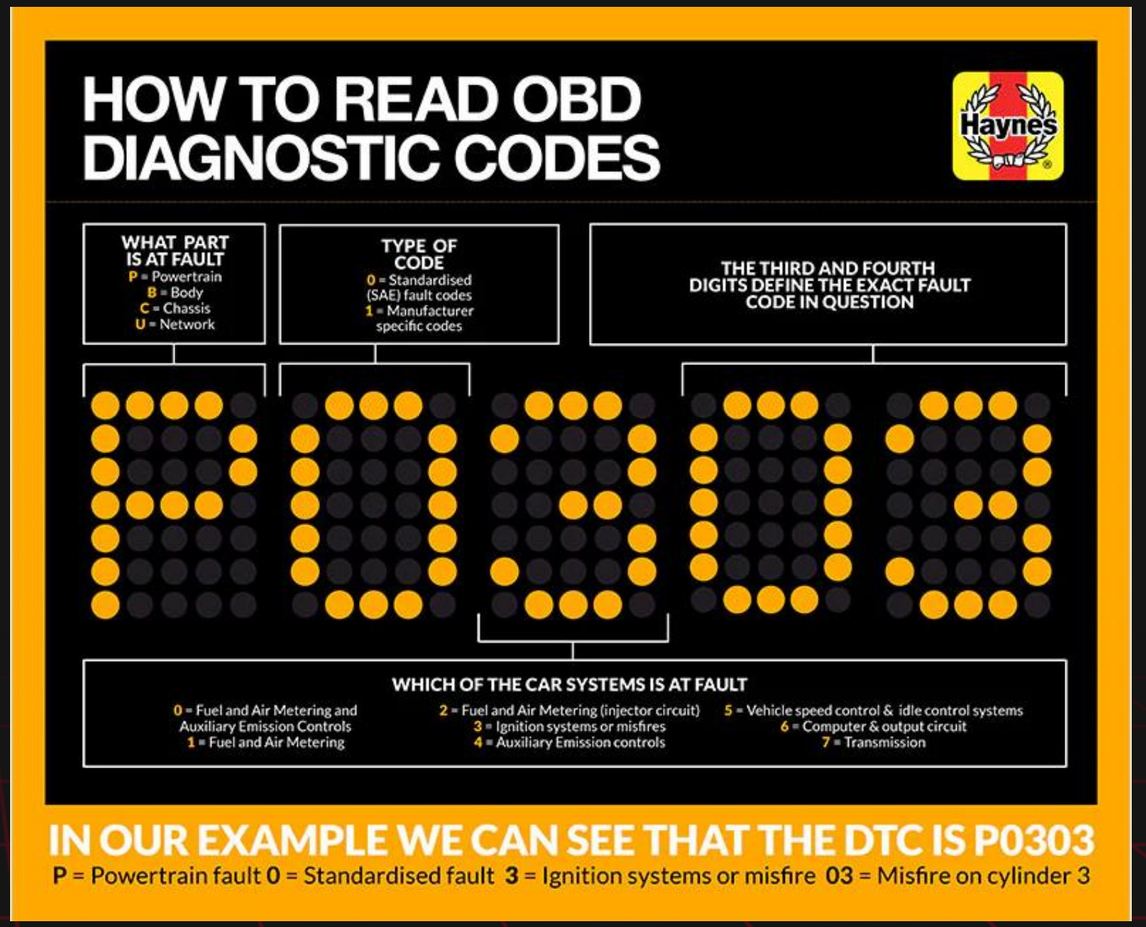
Logger System

Logger System

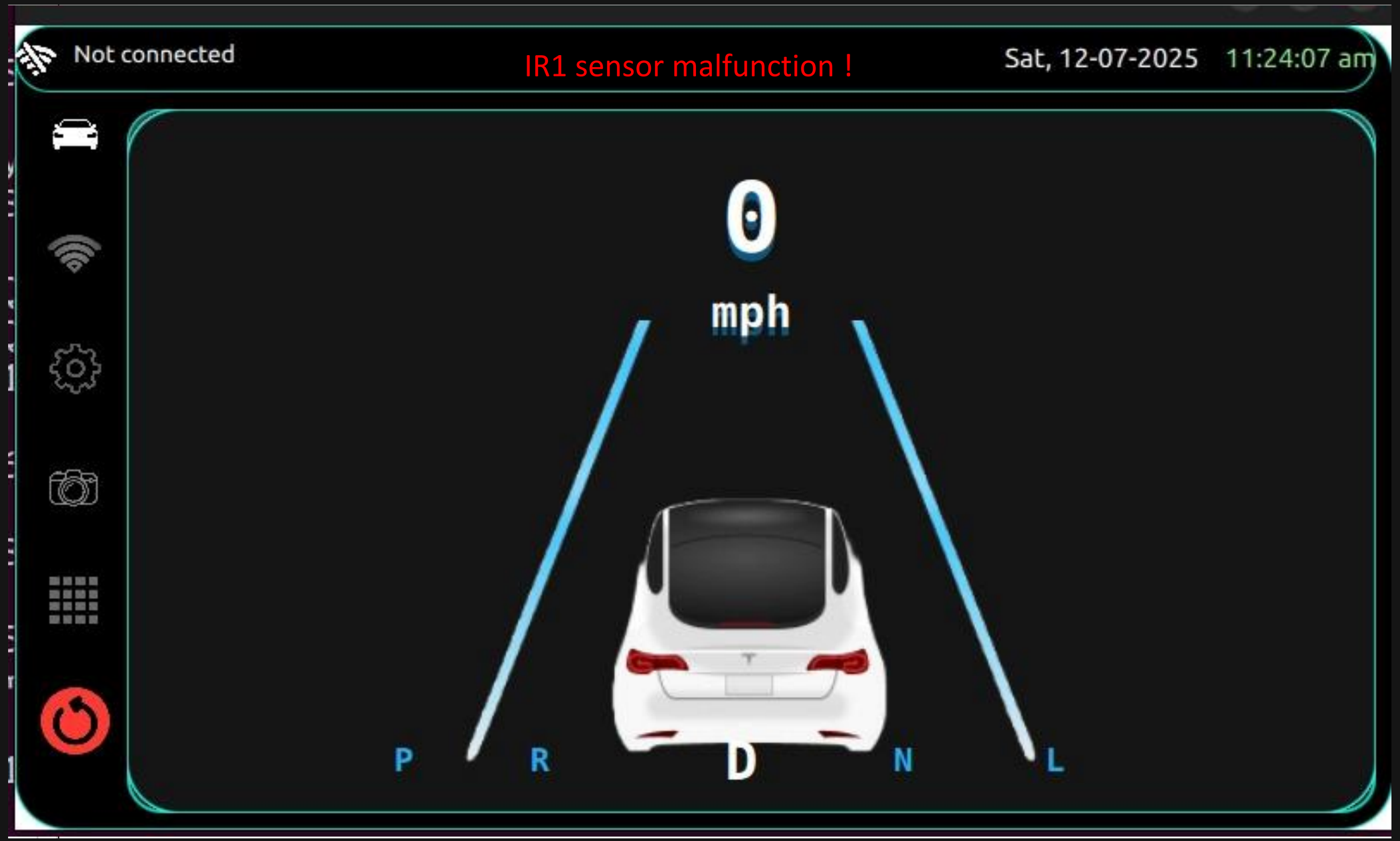
-Self-Diagnostic for each ADAS system

-Error management

Error management error management error management


HOW TO READ OBD DIAGNOSTIC CODES
Haynes
WHAT PART IS AT FAULT
P = Powertrain
B = Body
C = Chassis
U = Network
TYPE OF CODE
0 = Standardised (SAE) fault codes
1 = Manufacturer specific codes
THE THIRD AND FOURTH DIGITS DEFINE THE EXACT FAULT CODE IN QUESTION
P0303
WHICH OF THE CAR SYSTEMS IS AT FAULT
0 = Fuel and Air Metering and Auxiliary Emission Controls
1 = Fuel and Air Metering
2 = Fuel and Air Metering (injector circuit)
3 = Ignition systems or misfires
4 = Auxiliary Emission controls
5 = Vehicle speed control & idle control systems
6 = Computer & output circuit
7 = Transmission
IN OUR EXAMPLE WE CAN SEE THAT THE DTC IS P0303
P = Powertrain fault 0 = Standardised fault 3 = Ignition systems or misfire 03 = Misfire on cylinder 3

Output of system



Firmware Over-the-Air (FOTA)

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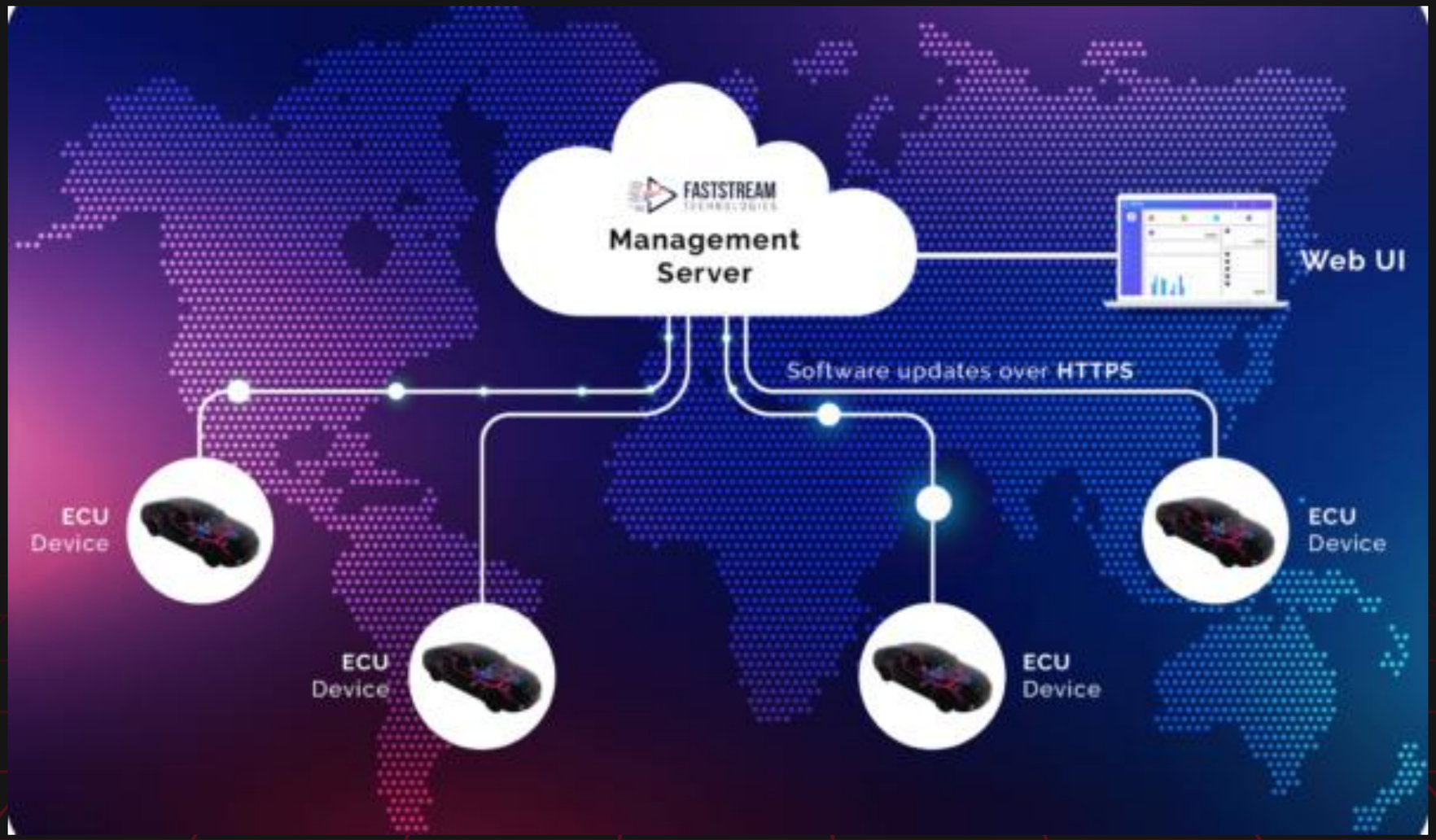
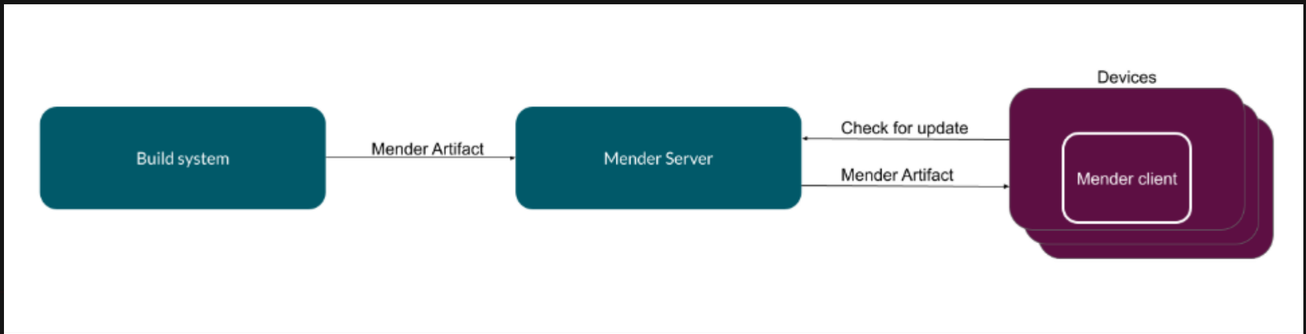
FOTA enables updates to:

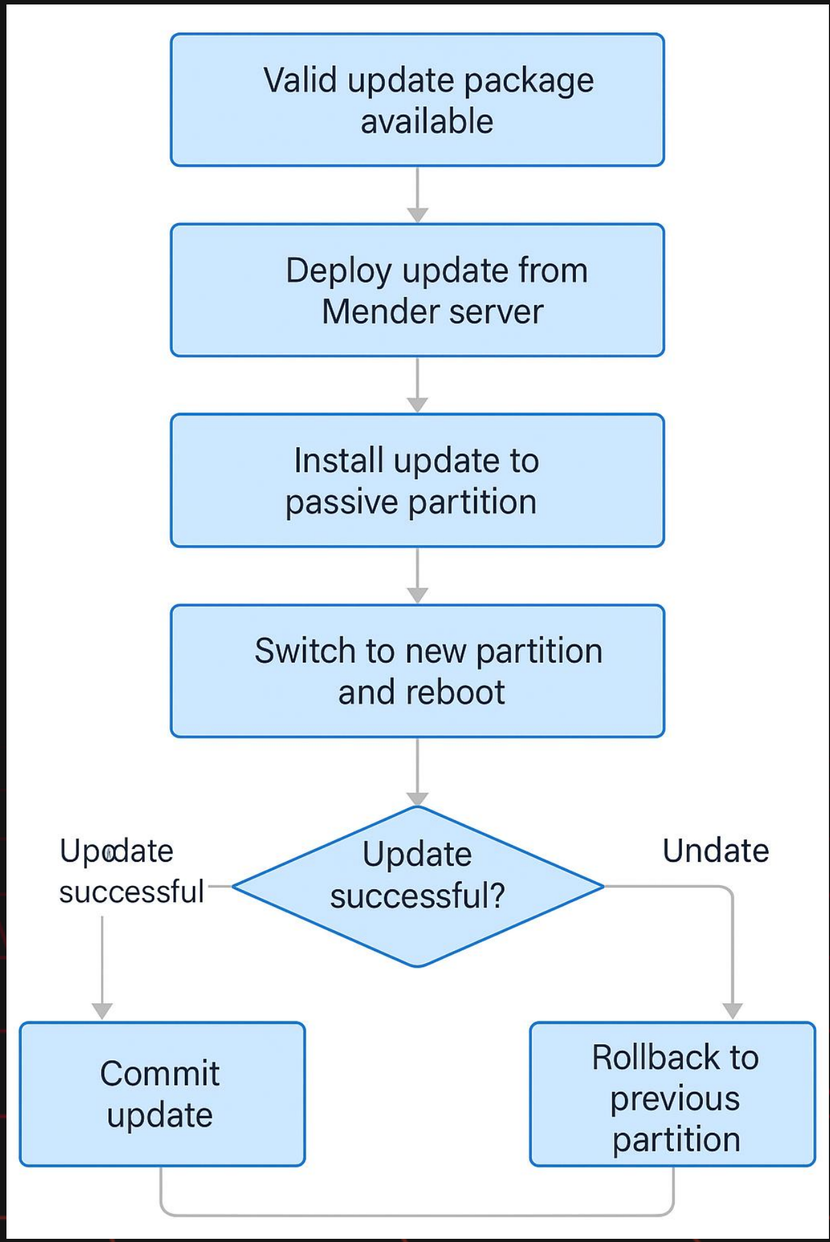
- **Fix bugs or security**
- **Add new features or enhance existing ones.**
- **Improve performance**

How system work?



How system work?



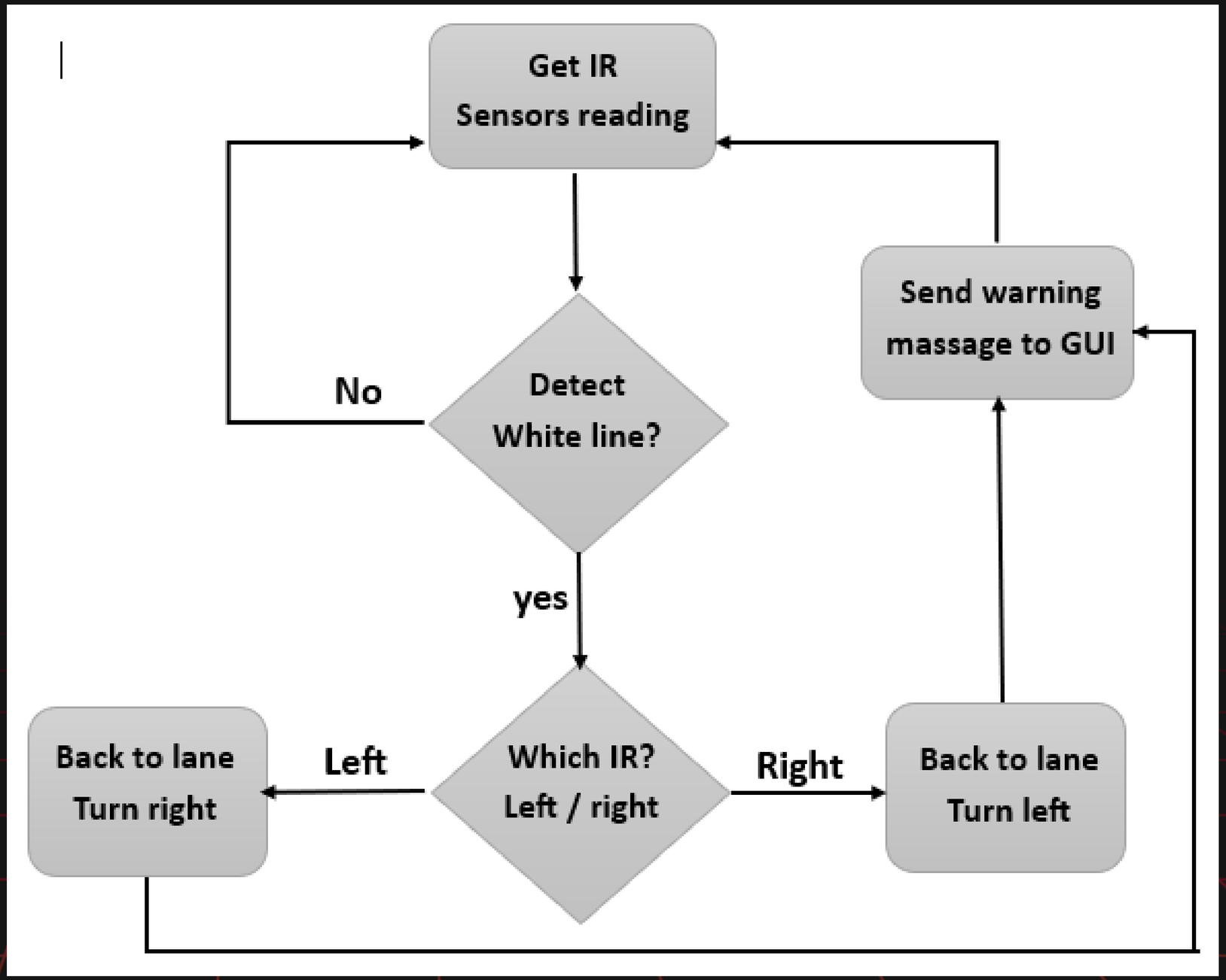


Lane Departure Warning (LDW)

Lane Departure Warning (LDW)

- Is a safety feature in vehicles that alerts the driver if the vehicle begins to drift out of its lane without the turn signal being used.
- When the system detects the white color in the road , the system sends warning massage appears in screen .
- ALSO THE SYSTEM CONTROLS THE DEPARTURE OF THE CAR TO KEEP THE CAR IN THE LANE

How the system works ?



Main System (GUI)

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- A Graphical User Interface (GUI) is a form of user interface that allows users to interact with electronic devices through graphical icons and visual indicators such as secondary notation.
- Enable communication between Subsystems
- Monitoring and Controlling Subsystems
- Fast response
- User Experience

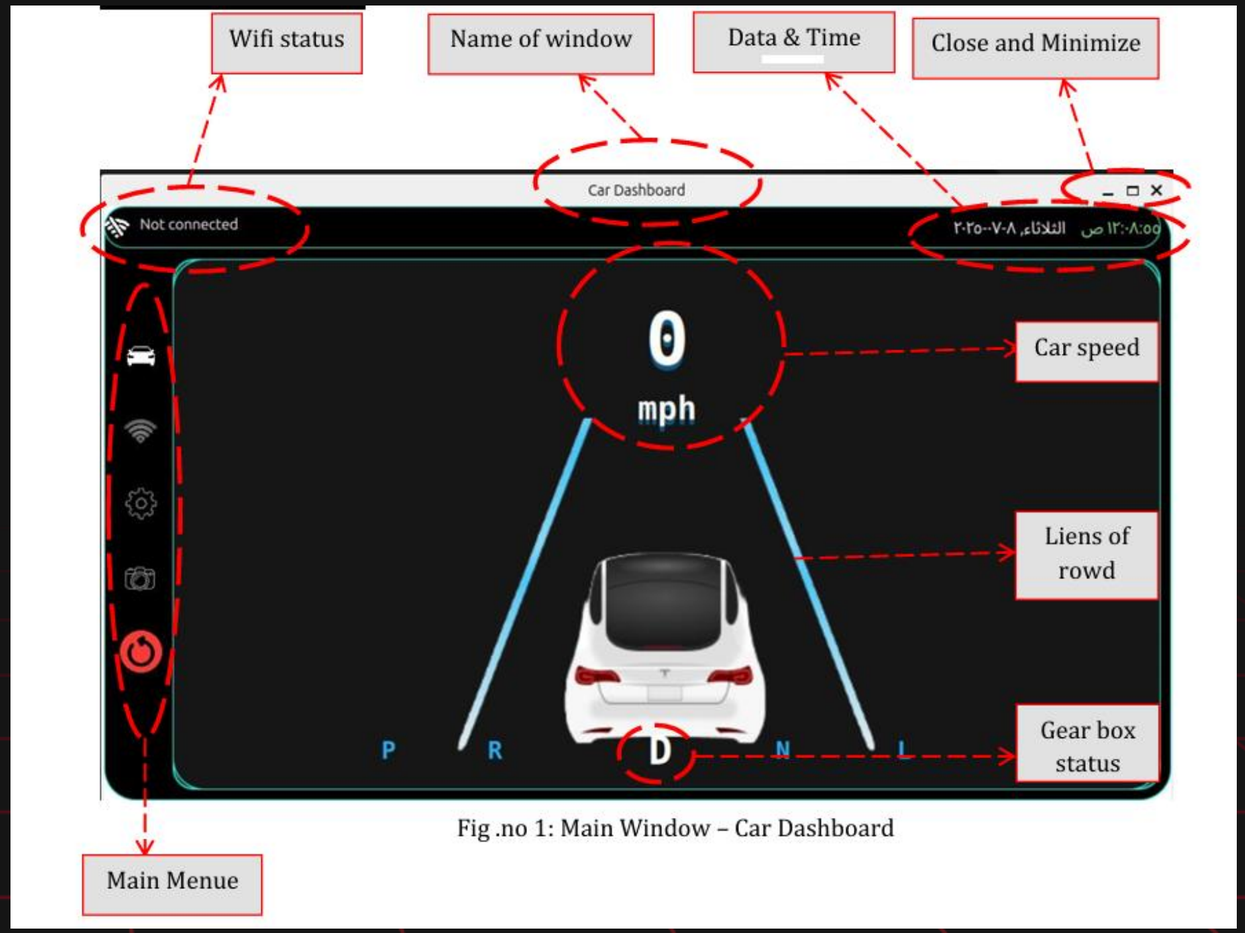
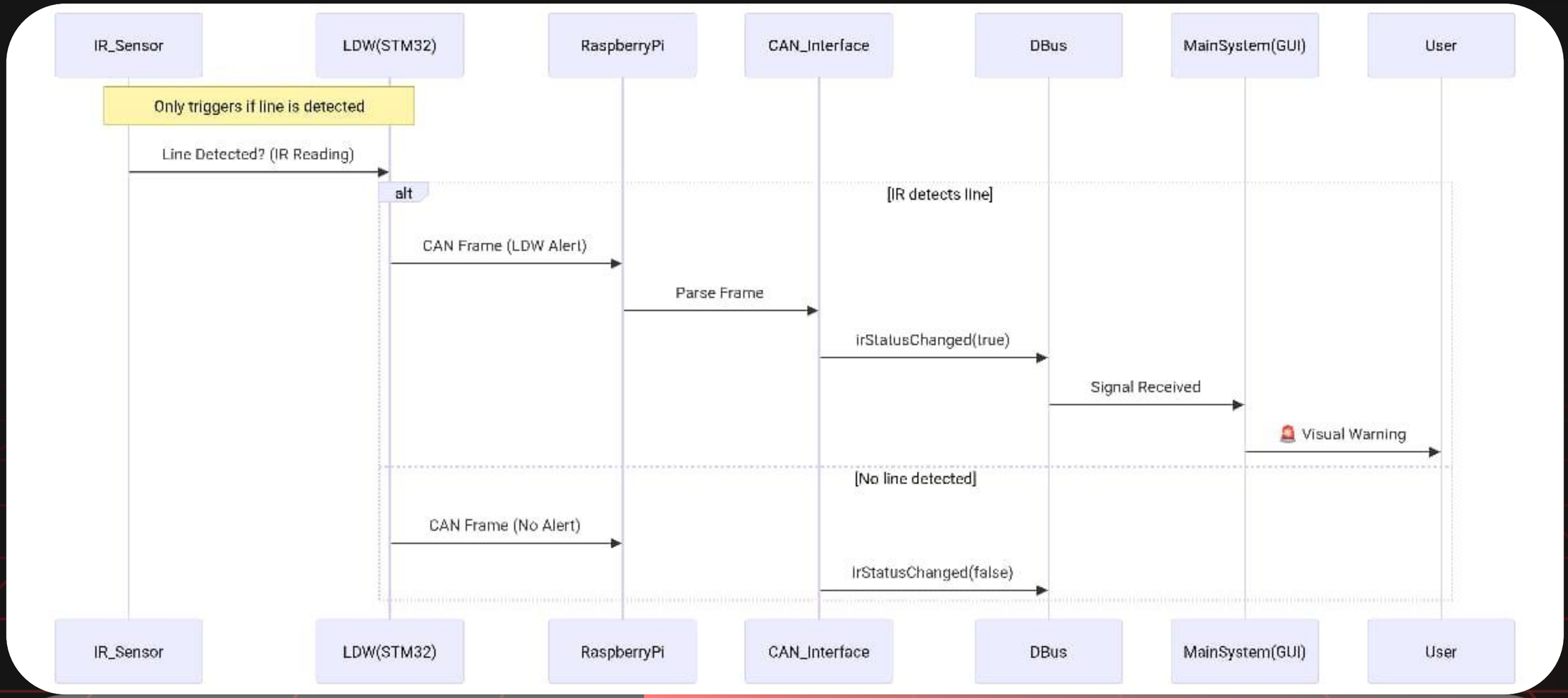
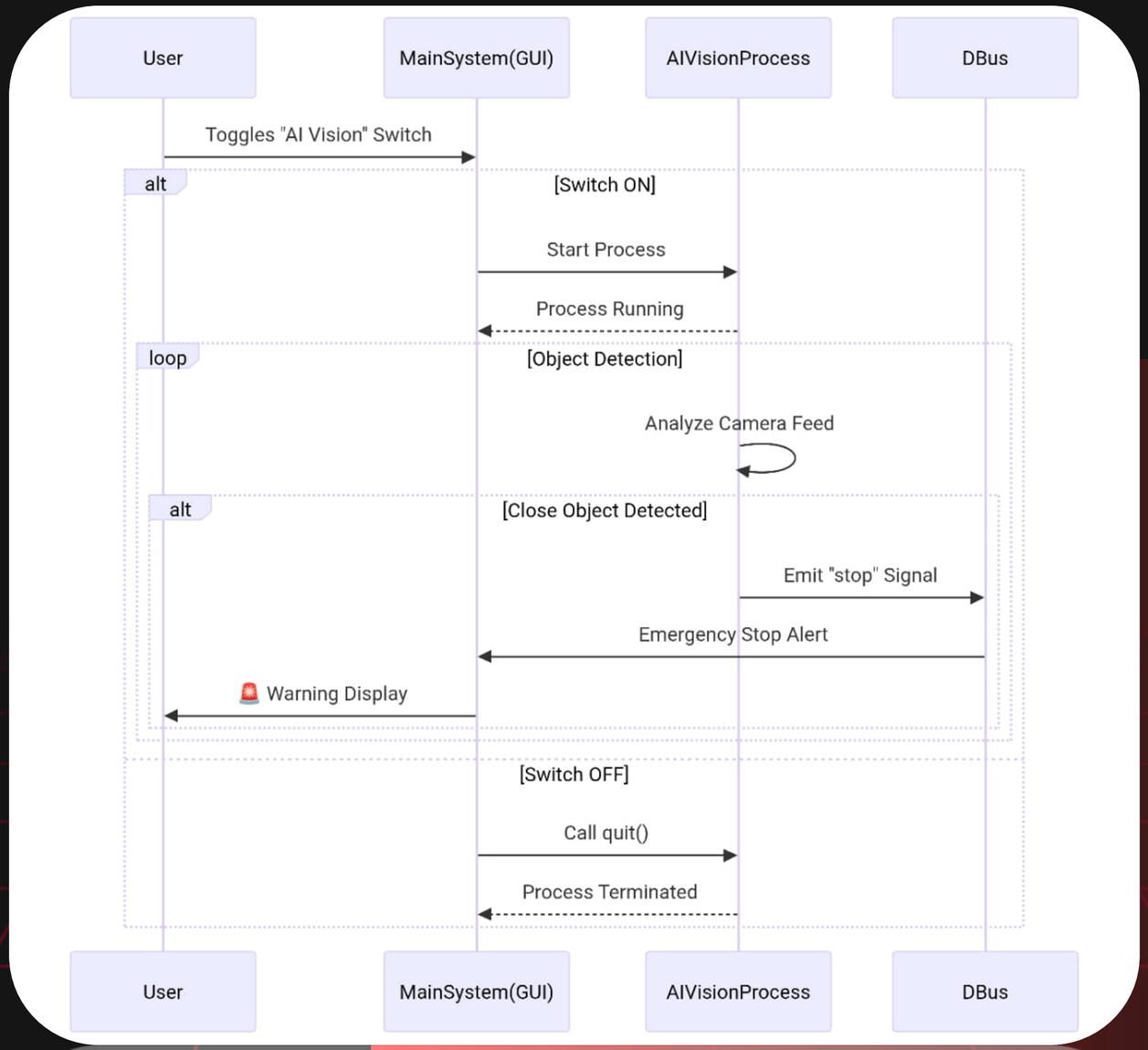


Fig .no 1: Main Window – Car Dashboard

Integration of LDW



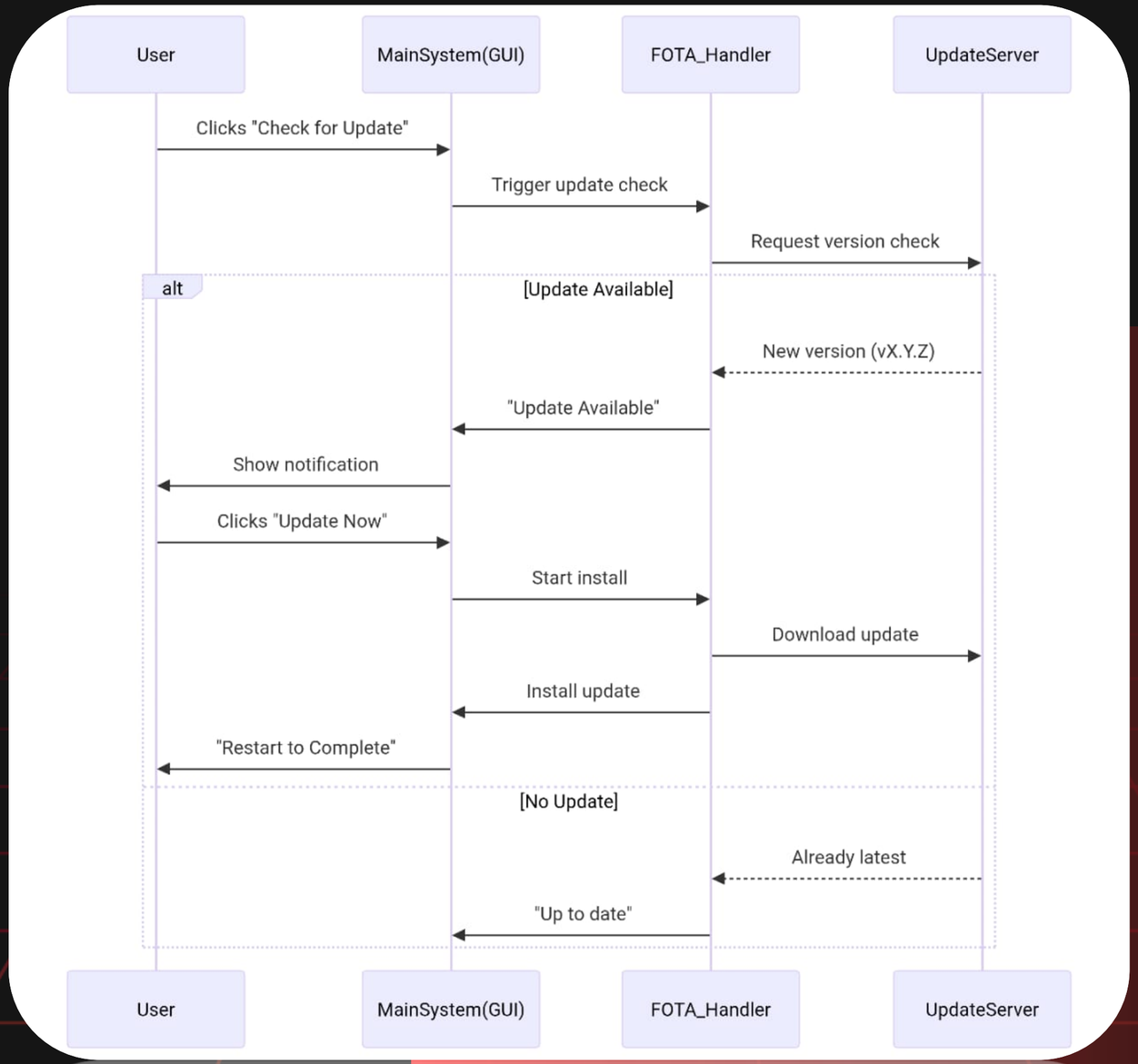
Integration Of AI Vision



- **Camera Window**

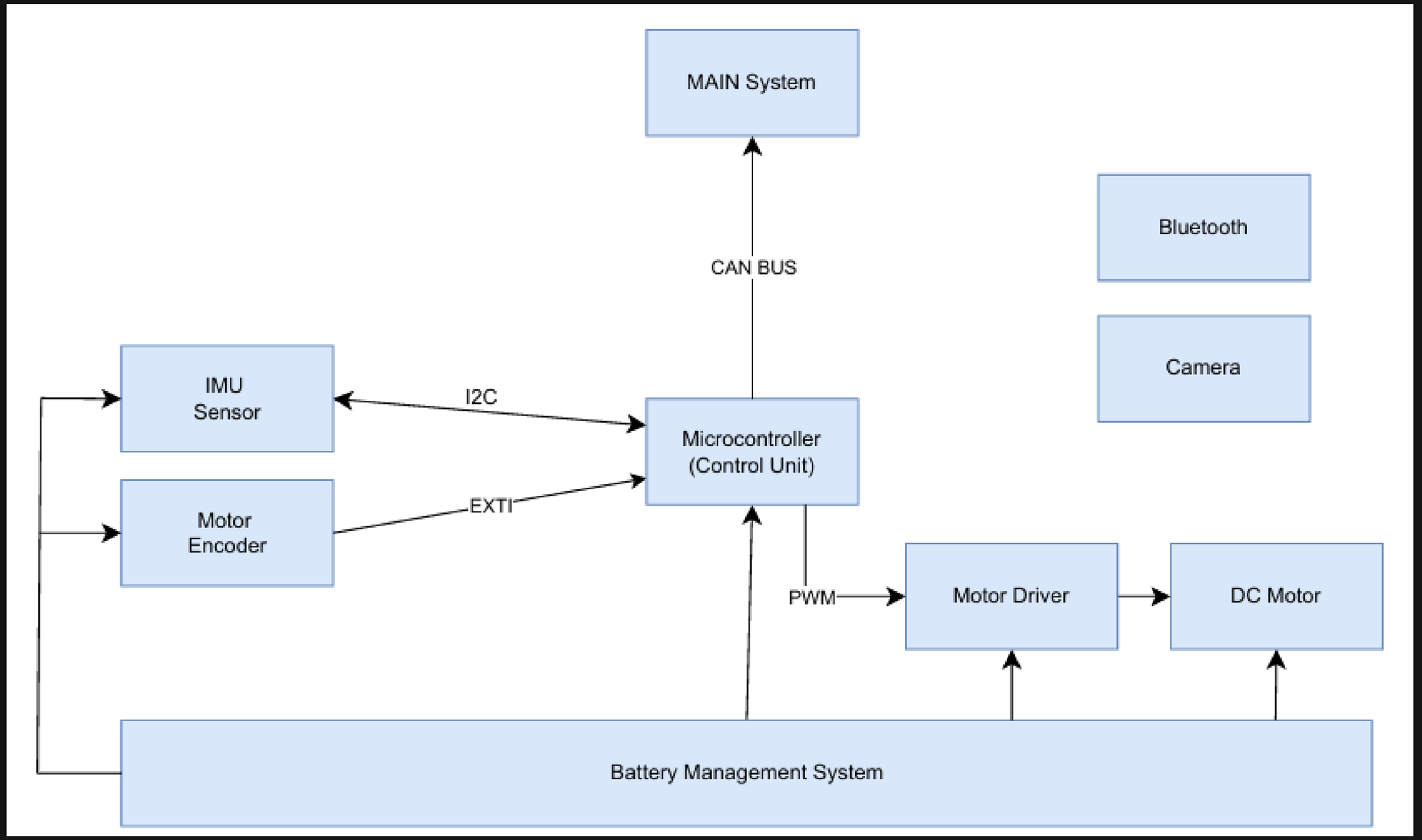
Fig .no 6: Control Window – Car Dashboard

Integration FOTA

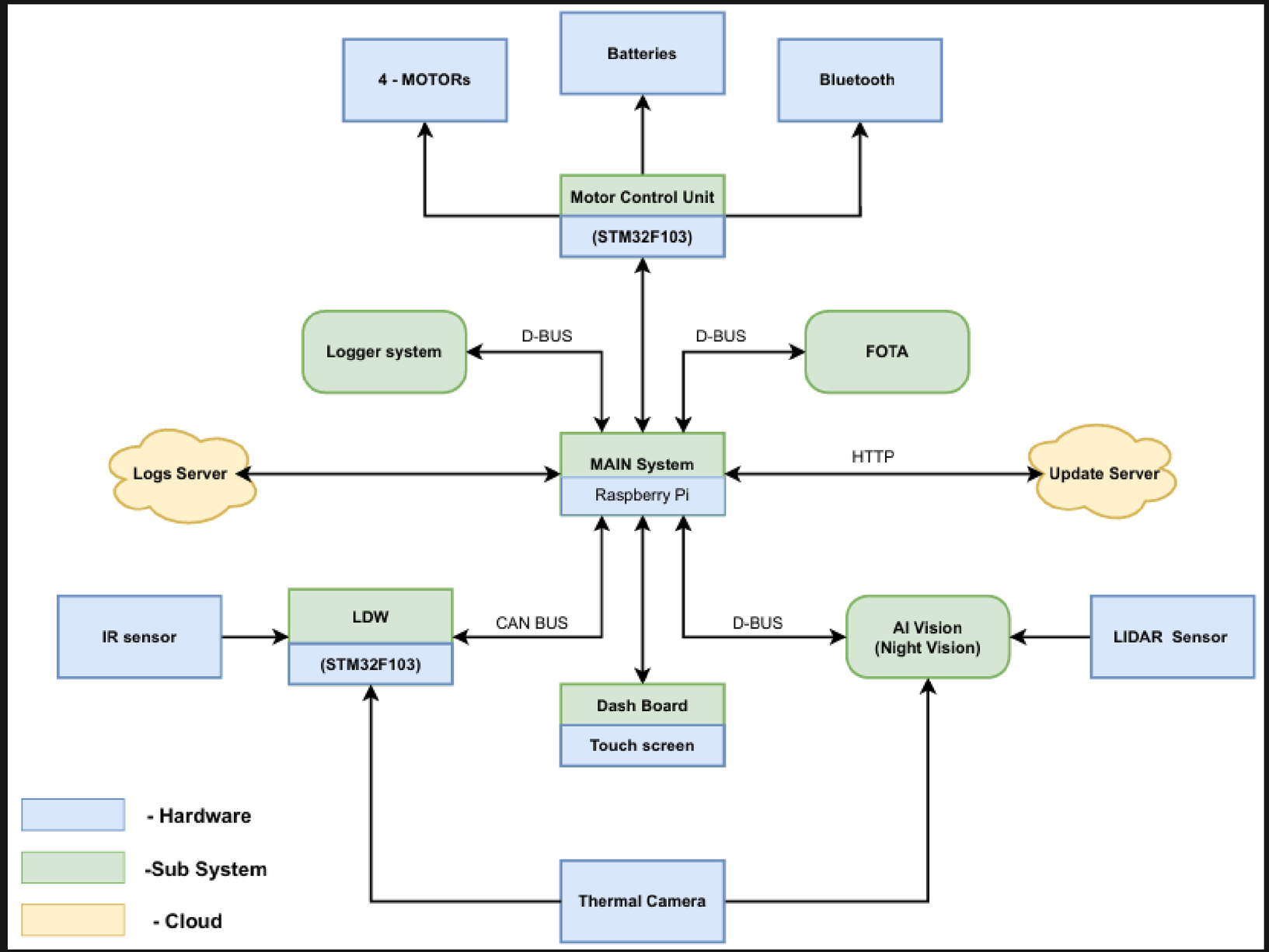


System Design

Block Diagram of Components



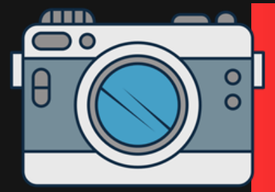
- **Project Design and Architecture:**



Tools

Tools

Pycharm



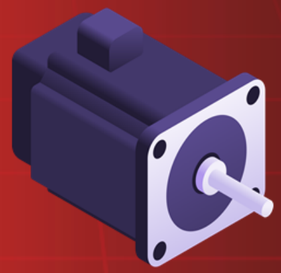
Camera

Git

OpenCv

Access Point

Wifi modules

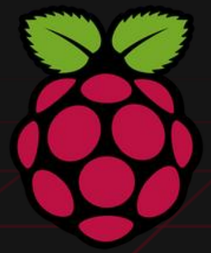


Servo motor

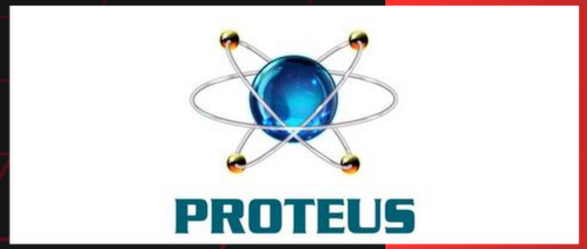
Tools

QT

QML



Raspberry Pii



Chat-gpt

VS Code

Conclusion

Conclusion

🚗 **Project Title: Logi-Drive AI Vision Pro**

A **C++-based Smart Vehicle Monitoring & Control ADAS Subsystems**, integrating embedded hardware and intelligent software to enhance driving safety and control.

The system brings together multiple subsystems into a unified, real-time platform running on a **Raspberry Pi 4** and **STM32 microcontroller**.

🔧 Project Highlights:

* 🚙 Vision-based **obstacle detection** and **distance estimation** using camera input.
* 🚧 **Lane Departure Warning (LDW)** ADAS Subsystem developed on STM32 and integrated with the main system via CAN bus.
* 🧩 **Subsystem integration** through modular Qt Core backend services (CAN, network, FOTA) communicating via **D-Bus IPC**.
* 🖥️ Qt/QML-based GUI for real-time monitoring, diagnostics, and control.
* 🌐 **Custom Network Manager** for managing wireless connectivity — including SSID scanning, secure connection handling, IP assignment (DHCP/static), and live network status updates.
* 📦 **FOTA updates** using Mender with custom deployment handling.
* 🛠️ Entire system developed in **modern C++,** both on **Qt Core (Linux)** and **STM32 firmware**.

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Any
questions

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THANK YOU